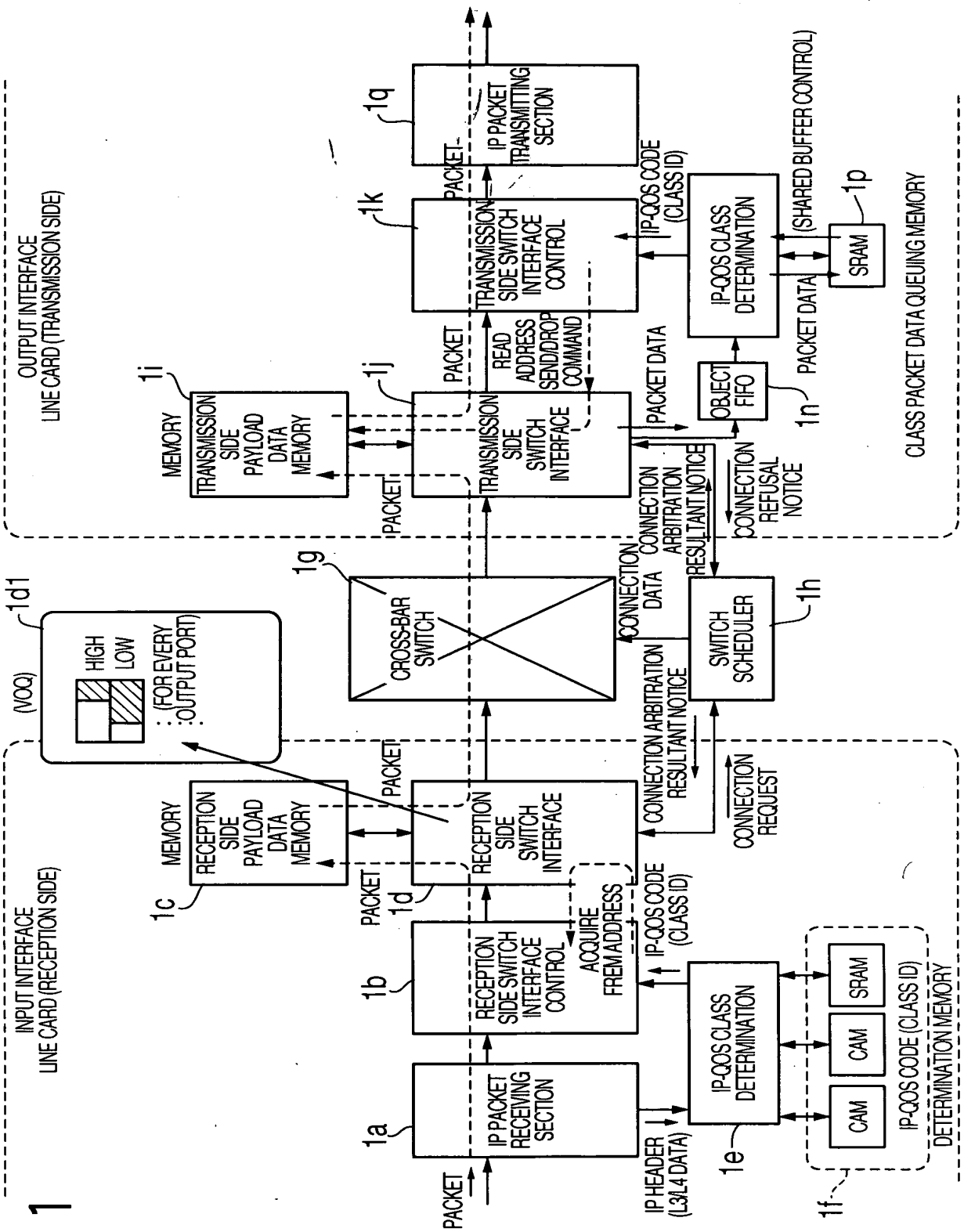
INPUT INTERFACE
LINE CARD (RECEPTION SIDE)
OUTPUT INTERFACE
LINE CARD (TRANSMISSION SIDE)
CLASS PACKET DATA QUEUING MEMORY
IP-QOS CODE DETERMINATION MEMORY
PACKET
IP PACKET RECEIVING SECTION
1a
RECEPTION SIDE SWITCH INTERFACE CONTROL
ACQUIRE FREM ADDRESS
1b
IP-QOS CODE (CLASS ID)
IP HEADER (L3/L4 DATA)
IP-QOS CLASS DETERMINATION
1e
CAM
SRAM
1f
MEMORY
RECEPTION SIDE PAYLOAD DATA MEMORY
1c
RECEPTION SIDE SWITCH INTERFACE
1d
(VOQ)
HIGH
LOW
: (FOR EVERY : OUTPUT PORT)
1d1
CROSS-BAR SWITCH
1g
CONNECTION ARBITRATION RESULTANT NOTICE
CONNECTION REQUEST
CONNECTION DATA
SWITCH SCHEDULER
1h
CONNECTION ARBITRATION RESULTANT NOTICE
CONNECTION REFUSAL NOTICE
MEMORY
TRANSMISSION SIDE PAYLOAD DATA MEMORY
1i
TRANSMISSION SIDE SWITCH INTERFACE
1j
READ ADDRESS SEND/DROP COMMAND
PACKET DATA
OBJECT FIFO
1n
IP-QOS CLASS DETERMINATION
IP-QOS CODE (CLASS ID)
TRANSMISSION SIDE SWITCH INTERFACE CONTROL
1k
(SHARED BUFFER CONTROL)
SRAM
1p
PACKET-
IP PACKET TRANSMITTING SECTION
1q

Fig. 1

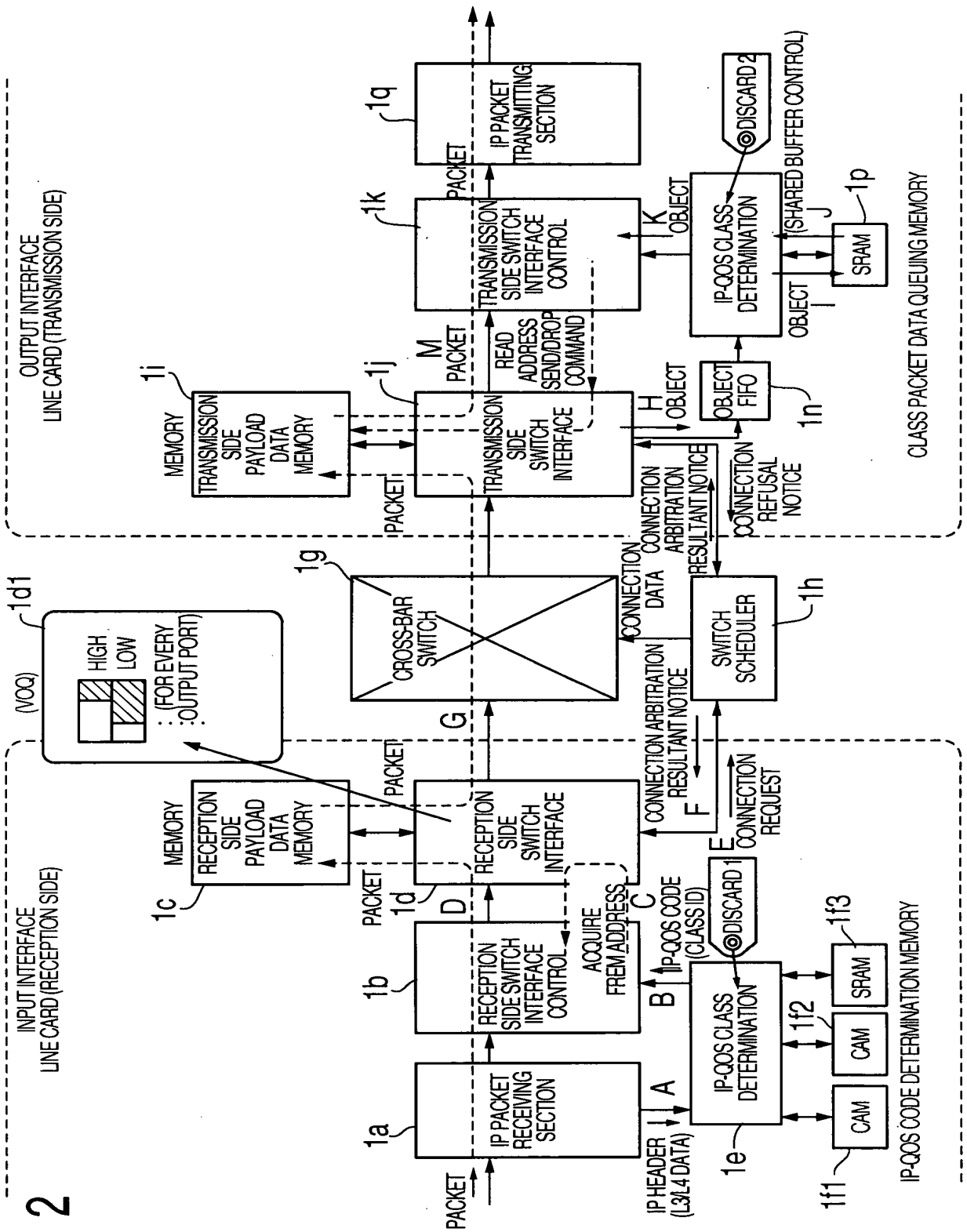
INPUT INTERFACE
LINE CARD (RECEPTION SIDE)
OUTPUT INTERFACE
LINE CARD (TRANSMISSION SIDE)
CLASS PACKET DATA QUEUING MEMORY
IP-QOS CODE DETERMINATION MEMORY
PACKET
IP HEADER (L3L4 DATA)
IP PACKET RECEIVING SECTION
RECEPTION SIDE SWITCH INTERFACE CONTROL
ACQUIRE FREM ADDRESS
IP-QOS CODE (CLASS ID)
IP-QOS CLASS DETERMINATION
CAM
SRAM
DISCARD 1
CONNECTION REQUEST
CONNECTION ARBITRATION RESULTANT NOTICE
RECEPTION SIDE SWITCH INTERFACE
RECEPTION SIDE PAYLOAD DATA MEMORY
(VOQ)
HIGH
LOW
: (FOR EVERY OUTPUT PORT)
CROSS-BAR SWITCH
CONNECTION DATA
SWITCH SCHEDULER
CONNECTION ARBITRATION RESULTANT NOTICE
CONNECTION REFUSAL NOTICE
TRANSMISSION SIDE SWITCH INTERFACE
TRANSMISSION SIDE PAYLOAD DATA MEMORY
READ ADDRESS SEND/DROP COMMAND
TRANSMISSION SIDE SWITCH INTERFACE CONTROL
OBJECT FIFO
OBJECT
IP-QOS CLASS DETERMINATION
DISCARD 2
(SHARED BUFFER CONTROL)
SRAM
IP PACKET TRANSMITTING SECTION
A
B
C
D
E
F
G
H
I
J
K
M
1a
1b
1c
1d
1d1
1e
1f1
1f2
1f3
1g
1h
1i
1j
1k
1n
1p
1q

Fig. 2

Fig. 3

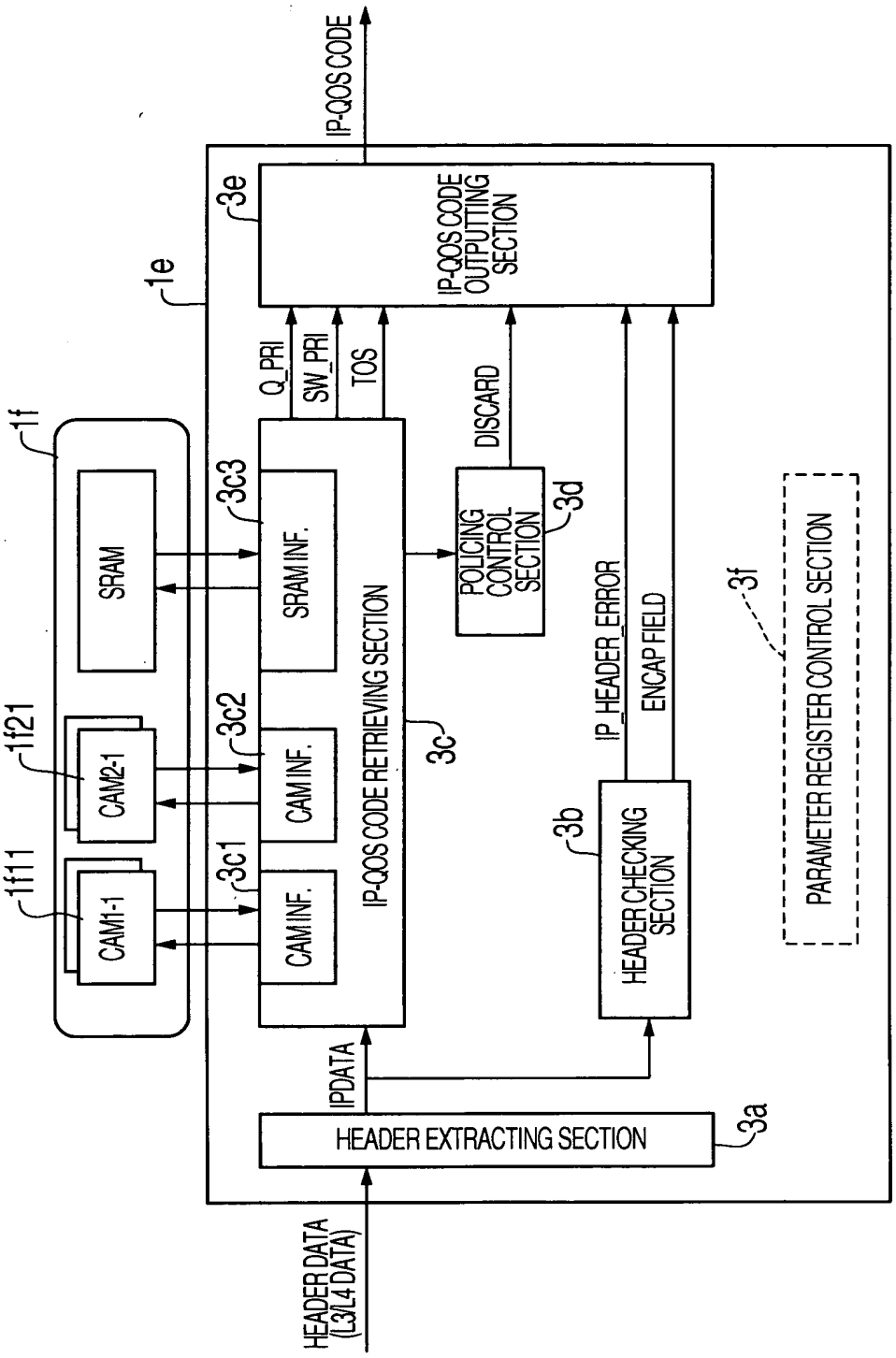
IP-QOS CODE
IP-QOS CODE OUTPUTTING SECTION
3e
1e
Q_PRI
SW_PRI
TOS
DISCARD
POLICING CONTROL SECTION
3d
1f
SRAM
3c3
SRAM INF.
1f21
CAM2-1
3c2
CAM INF.
1f11
CAM1-1
3c1
CAM INF.
IP-QOS CODE RETRIEVING SECTION
3c
IP_HEADER_ERROR
ENCAP FIELD
3f
PARAMETER REGISTER CONTROL SECTION
3b
HEADER CHECKING SECTION
IPDATA
HEADER EXTRACTING SECTION
3a
HEADER DATA (L3/L4 DATA)

Fig. 4

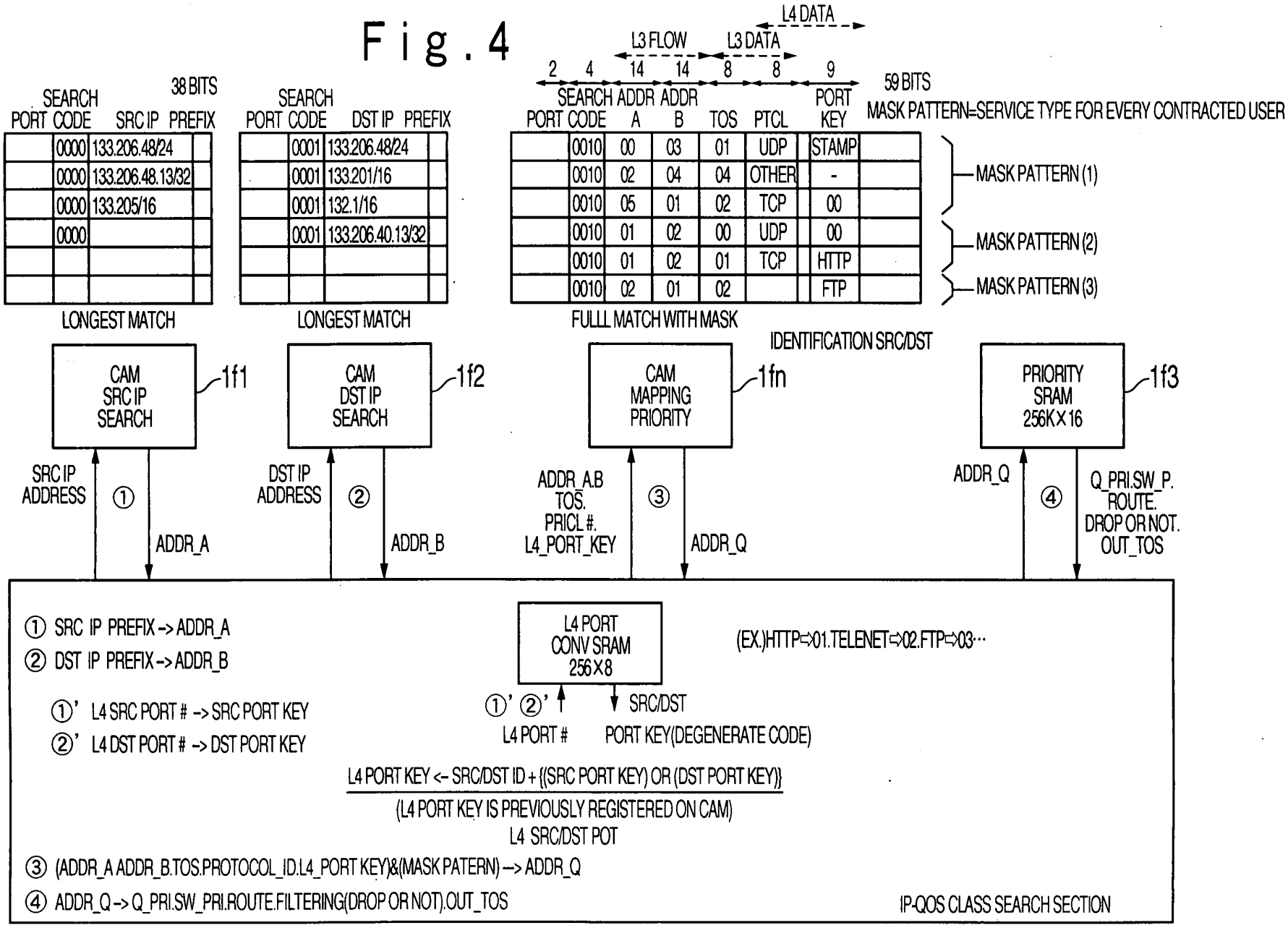
L4 DATA
L3 FLOW
L3 DATA
2 4 14 14 8 8 9
59 BITS
MASK PATTERN=SERVICE TYPE FOR EVERY CONTRACTED USER
38 BITS
SEARCH PORT CODE SRC IP PREFIX
0000 133.206.48/24
0000 133.206.48.13/32
0000 133.205/16
0000
SEARCH PORT CODE DST IP PREFIX
0001 133.206.48/24
0001 133.201/16
0001 132.1/16
0001 133.206.40.13/32
SEARCH PORT CODE ADDR A ADDR B TOS PTCL PORT KEY
0010 00 03 01 UDP STAMP
0010 02 04 04 OTHER -
0010 05 01 02 TCP 00
0010 01 02 00 UDP 00
0010 01 02 01 TCP HTTP
0010 02 01 02 FTP
MASK PATTERN (1)
MASK PATTERN (2)
MASK PATTERN (3)
LONGEST MATCH
LONGEST MATCH
FULLL MATCH WITH MASK
IDENTIFICATION SRC/DST
CAM SRC IP SEARCH
1f1
CAM DST IP SEARCH
1f2
CAM MAPPING PRIORITY
1fn
PRIORITY SRAM 256K X 16
1f3
SRC IP ADDRESS
①
ADDR_A
DST IP ADDRESS
②
ADDR_B
ADDR_A.B TOS. PRICL #. L4_PORT_KEY
③
ADDR_Q
ADDR_Q
④
Q_PRI.SW_P. ROUTE. DROP OR NOT. OUT_TOS
① SRC IP PREFIX -> ADDR_A
② DST IP PREFIX -> ADDR_B
L4 PORT CONV SRAM 256 X 8
(EX.)HTTP⇨01.TELENET⇨02.FTP⇨03···
①' L4 SRC PORT # -> SRC PORT KEY
②' L4 DST PORT # -> DST PORT KEY
①' ②'
L4 PORT #
SRC/DST
PORT KEY(DEGENERATE CODE)
L4 PORT KEY <- SRC/DST ID + {(SRC PORT KEY) OR (DST PORT KEY)}
(L4 PORT KEY IS PREVIOUSLY REGISTERED ON CAM)
L4 SRC/DST POT
③ (ADDR_A ADDR_B.TOS.PROTOCOL_ID.L4_PORT KEY)&(MASK PATERN) --> ADDR_Q
④ ADDR_Q -> Q_PRI.SW_PRI.ROUTE.FILTERING(DROP OR NOT).OUT_TOS
IP-QOS CLASS SEARCH SECTION

Fig. 5

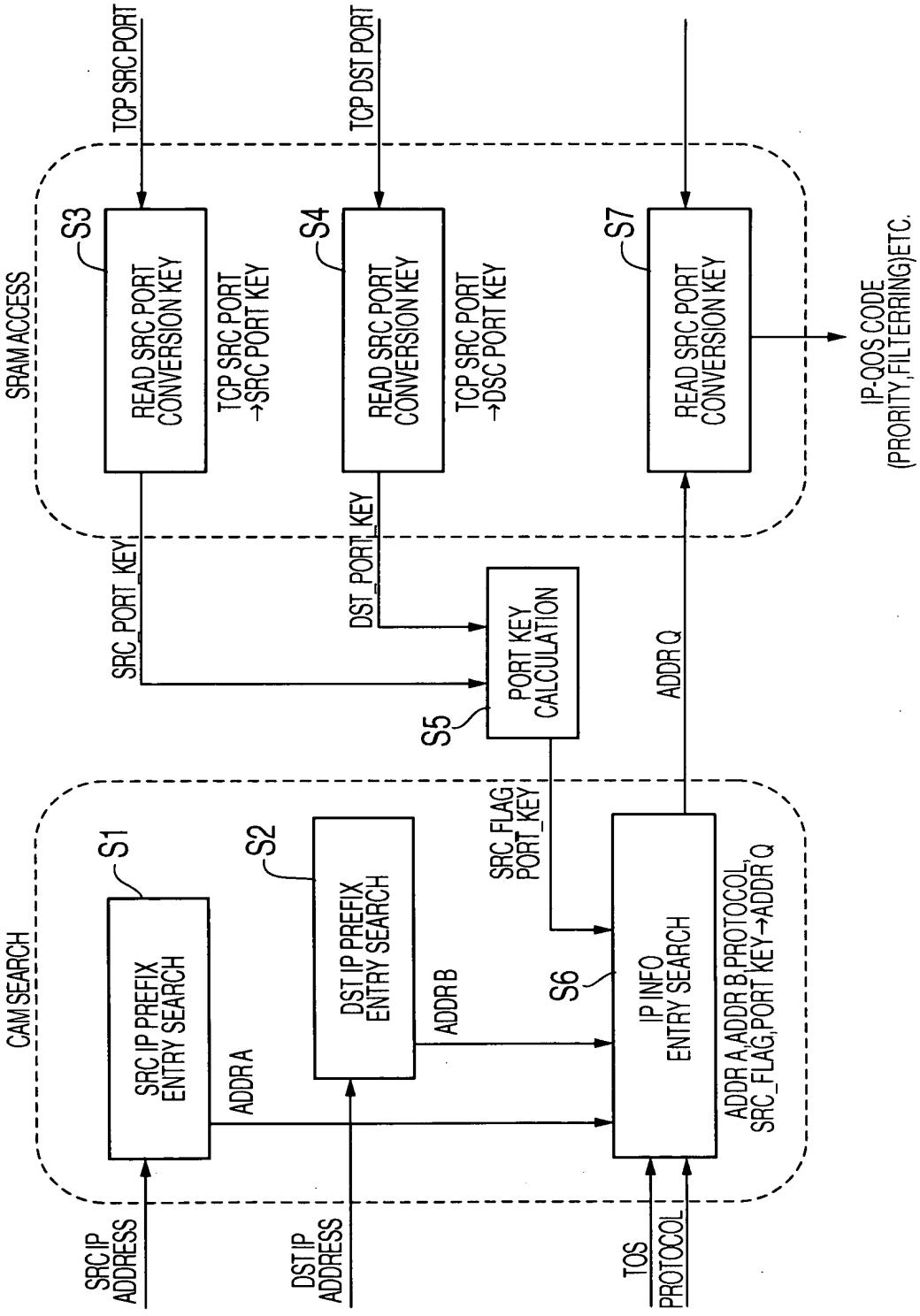
CAM SEARCH
SRAM ACCESS
SRC IP ADDRESS
DST IP ADDRESS
TOS
PROTOCOL
SRC IP PREFIX ENTRY SEARCH
DST IP PREFIX ENTRY SEARCH
IP INFO ENTRY SEARCH
ADDR A
ADDR B
ADDR A,ADDR B,PROTOCOL, SRC_FLAG,PORT KEY→ADDR Q
SRC_FLAG PORT_KEY
S1
S2
S6
READ SRC PORT CONVERSION KEY
TCP SRC PORT →SRC PORT KEY
TCP SRC PORT →DSC PORT KEY
S3
S4
S7
TCP SRC PORT
TCP DST PORT
SRC_PORT_KEY
DST_PORT_KEY
PORT KEY CALCULATION
S5
ADDR Q
IP-QOS CODE (PRORITY,FILTERRING)ETC.

Fig. 6A

【CAM REGION DIVISION】

CAM ADDRESS	CAM DATA (MAX.64 BITS)	MASK PATTERN (64 BITS)	SEARCH METHOD
ADDR_A~	IP SRC PREFIX ENTRY STORAGE REGION		LONGEST MATCH
ADDR_B~	IP DST PREFIX ENTRY STORAGE REGION		LONGEST MATCH
ADDR_Q~	IP INFO SEARCH ENTRY STORAGE REGION		FULL MATCH WITH MASK

Fig. 6B

【1,IP SRC PREFIX ENTRY STORAGE REGION : SEARCH CODE 0000】

CAM ADDRESS (ADDR_A)	CAM DATA (38 BITS)			
	HW #(2)	SEARCH CODE(4)	IP SRC ADRESS/ PREFIX(32BITS)	NON USED(26 BITS)
A #1	00	0000	IP SRC ADDRESS #1/PREFIX	
A #2	00	0000	IP SRC ADDRESS #2/PREFIX	
A #3	01	0000	IP SRC ADDRESS #1/PREFIX	
⋮	⋮	⋮	⋮	

Fig. 7A

【2,IP DST PREFIX ENTRY STORAGE REGION : SEARCH CODE 0001】

CAM ADDRESS (ADDR_B)	CAM DATA (38 BITS)			
	HW #(2)	SEARCH CODE(4)	IP DST ADDRESS/ PREFIX(32BITS)	NON USED(26 BITS)
B #1	00	0001	IP DST ADDRESS #1/PREFIX	
B #2	00	0001	IP DST ADDRESS #2/PREFIX	
B #3	01	0001	IP DST ADDRESS #1/PREFIX	
⋮	⋮	⋮	⋮	

Fig. 7B

【3,IP INFO ADDRESS ENTRY STORAGE REGION : SEARCH CODE 0010】

CAM ADDRESS (ADDR_Q)	CAM DATA (55 BITS)								
	HW #(2)	SEARCH CODE(4)	ADDR A(14)	ADDR B(14)	TOS (8)	PROTO COL# (8)	SRC/ DST (1)	PORT KEY (8)	NON USED (5 BITS)
Q #1	00	0010	A1	B1	01	TCP	S	HTTP	
Q #2	00	0010	A1	B2	04	UDP	D	SNMP	
Q #3	01	0010	A3	B1	02	TCP	S	FTP	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	

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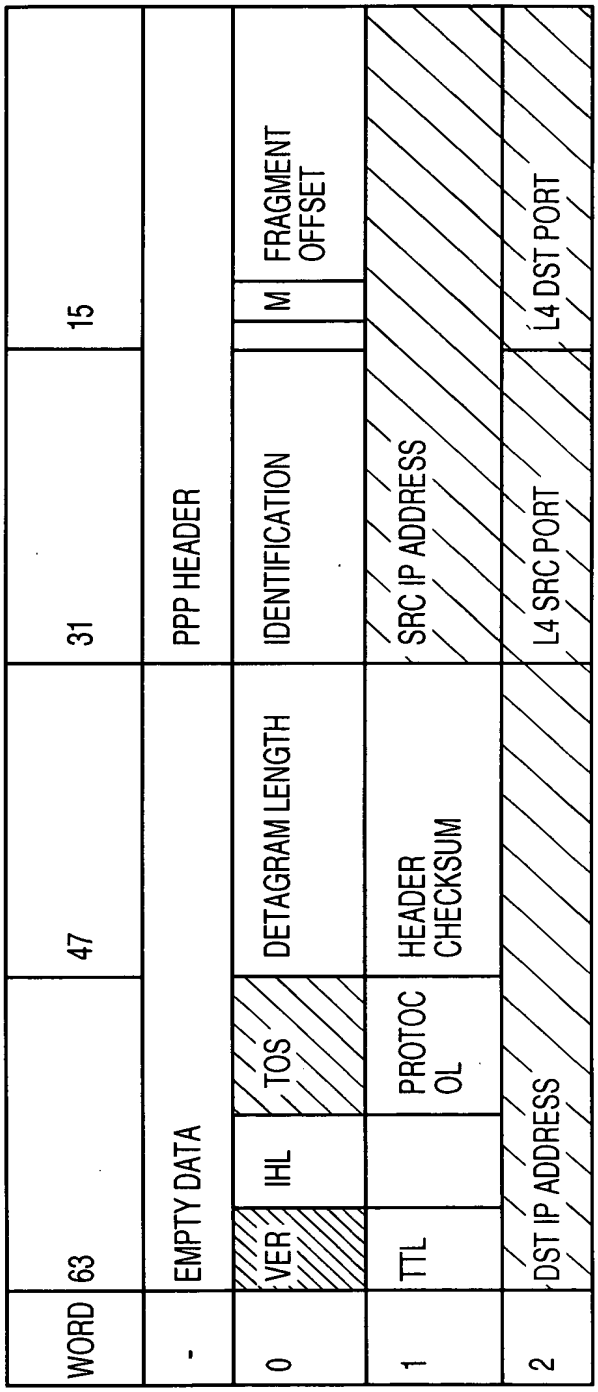
Fig. 8

【IP INFO ENTRY】

ADDRESS(16 BITS) : UPPER 2 BITS=00 LOWER 14 BITS=HIT ADDR_Q	DATA(24 BIT)							
	Q_PRI(4)	D	P	ROUTE(1+4)		OUTPUT TOS(2+8)		RESERVE (3)
ADDR Q0	0000	0	0	0	0000	11	011011 00	
ADDR Q1	1101	0	1	0	0000	11	011010 00	
ADDR Q2	1101	0	0	0	0000	00	000000 00	
⋮	⋮	⋮	⋮		⋮		⋮	
ADDR QI	1110	0	1	1	0101	00	000000 00	
⋮	⋮	⋮	⋮		⋮		⋮	

Fig. 9

(IPV4 & TCP/UDP/OTHER HEADER FORMAT)



F06040 "62525420

Fig. 10

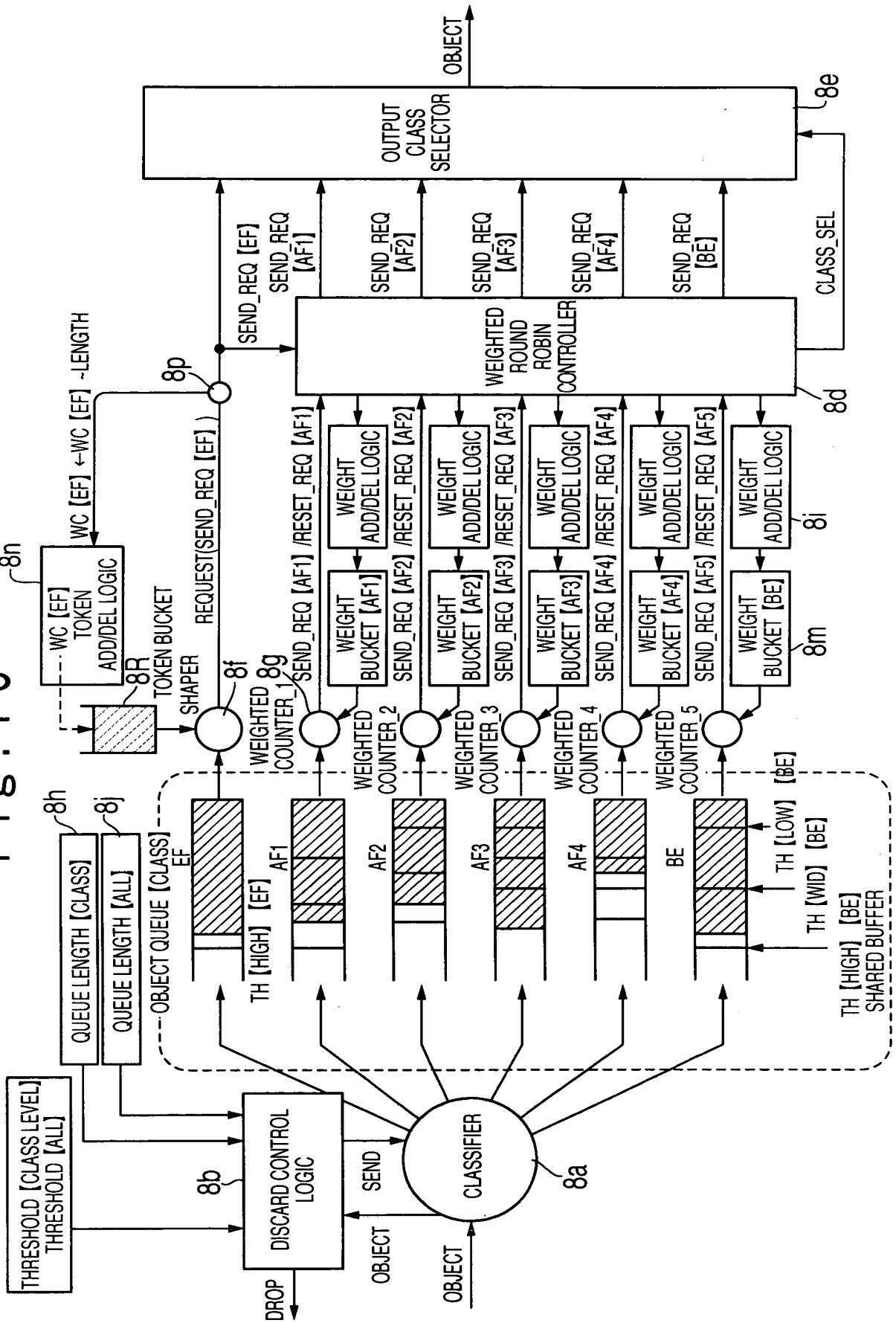


Fig. 11

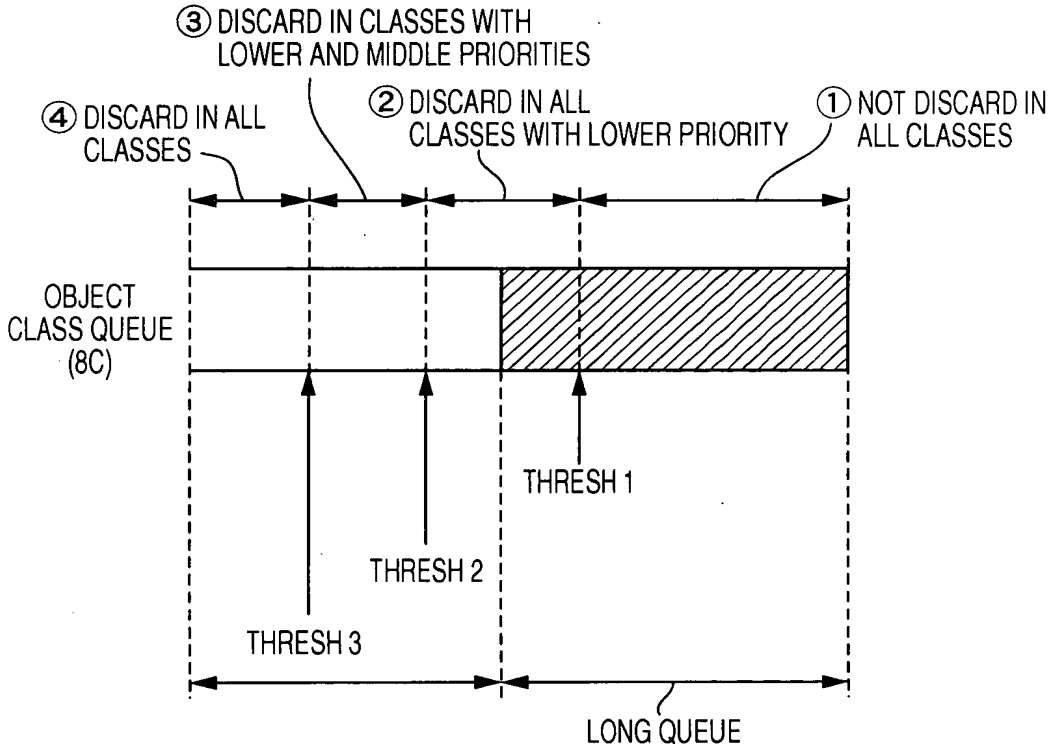

③ DISCARD IN CLASSES WITH LOWER AND MIDDLE PRIORITIES
④ DISCARD IN ALL CLASSES
② DISCARD IN ALL CLASSES WITH LOWER PRIORITY
① NOT DISCARD IN ALL CLASSES
OBJECT CLASS QUEUE (8C)
THRESH 1
THRESH 2
THRESH 3
LONG QUEUE

Fig. 12

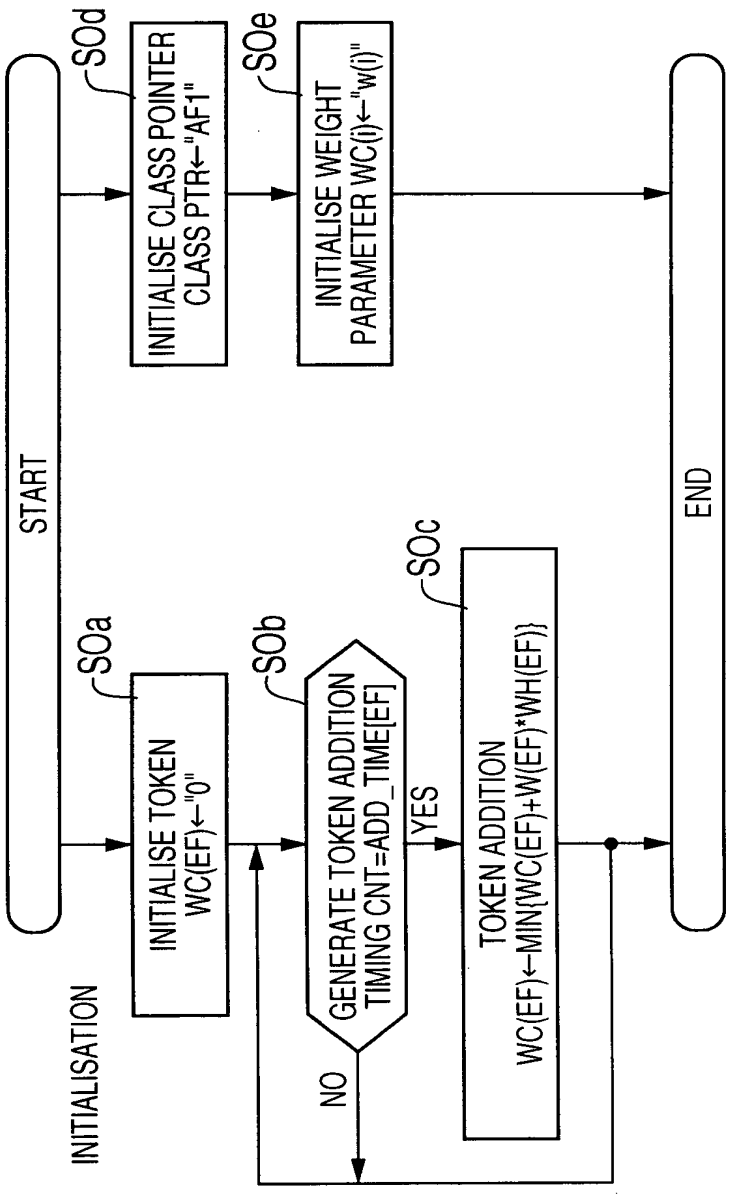


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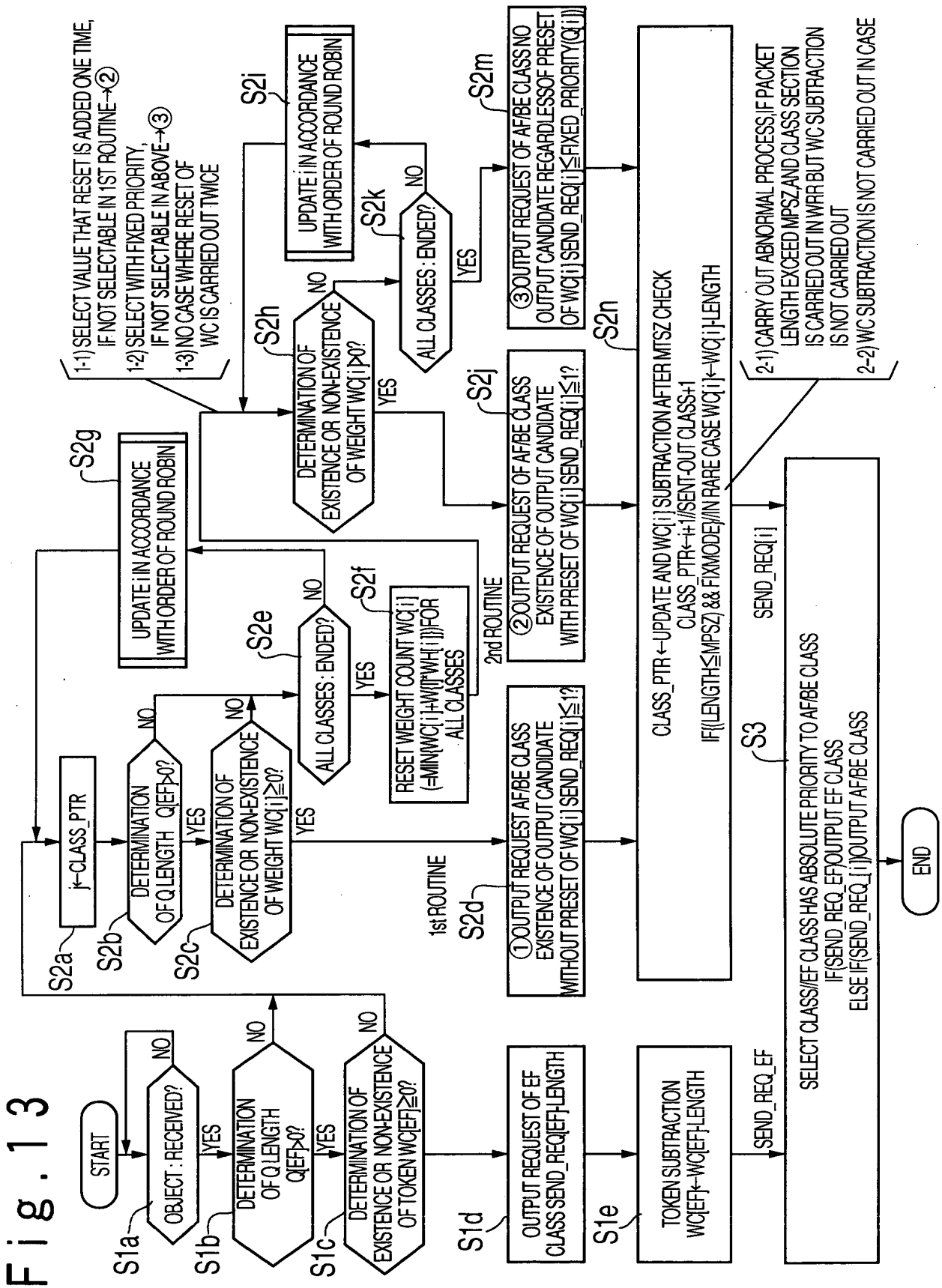
Fig. 13


START
S1a
OBJECT : RECEIVED?
YES
NO
S1b
DETERMINATION OF Q LENGTH QIEFI>0?
YES
NO
S1c
DETERMINATION OF EXISTENCE OR NON-EXISTENCE OF TOKEN WC[EF]≧0?
YES
NO
S1d
OUTPUT REQUEST OF EF CLASS SEND_REQ[EF]=LENGTH
S1e
TOKEN SUBTRACTION WC[EF]←WC[EF]-LENGTH
SEND_REQ_EF
S3
SELECT CLASS/EF CLASS HAS ABSOLUTE PRIORITY TO AF/BE CLASS
IF(SEND_REQ_EF)OUTPUT EF CLASS
ELSE IF(SEND_REQ_[i])OUTPUT AF/BE CLASS
SEND_REQ[i]
END
S2a
j←CLASS_PTR
S2b
DETERMINATION OF Q LENGTH QIEFI>0?
YES
NO
S2c
DETERMINATION OF EXISTENCE OR NON-EXISTENCE OF WEIGHT WC[i]≧0?
YES
NO
S2d
1st ROUTINE
①OUTPUT REQUEST AF/BE CLASS EXISTENCE OF OUTPUT CANDIDATE WITHOUT PRESET OF WC[i] SEND_REQ[i]≦1?
S2e
ALL CLASSES : ENDED?
YES
NO
S2f
RESET WEIGHT COUNT WC[i] (=MIN(WC[i]+W[i]*WH[i]))FOR ALL CLASSES
S2g
UPDATE i IN ACCORDANCE WITH ORDER OF ROUND ROBIN
2nd ROUTINE
S2h
DETERMINATION OF EXISTENCE OR NON-EXISTENCE OF WEIGHT WC[i]>0?
YES
NO
S2i
UPDATE i IN ACCORDANCE WITH ORDER OF ROUND ROBIN
S2j
②OUTPUT REQUEST OF AF/BE CLASS EXISTENCE OF OUTPUT CANDIDATE WITH PRESET OF WC[i] SEND_REQ[i]≦1?
S2k
ALL CLASSES : ENDED?
YES
NO
S2m
③OUTPUT REQUEST OF AF/BE CLASS NO OUTPUT CANDIDATE REGARDLESS OF PRESET OF WC[i] SEND_REQ[i]≦FIXED_PRIORITY(Q[i])
S2n
CLASS_PTR←UPDATE AND WC[i] SUBTRACTION AFTER MTSZ CHECK
CLASS_PTR←i+1//SENT-OUT CLASS+1
IF((LENGTH≦MPSZ) && FIXMODE)//IN RARE CASE WC[i]←WC[i]-LENGTH
1-1) SELECT VALUE THAT RESET IS ADDED ONE TIME, IF NOT SELECTABLE IN 1ST ROUTINE→②
1-2) SELECT WITH FIXED PRIORITY, IF NOT SELECTABLE IN ABOVE→③
1-3) NO CASE WHERE RESET OF WC IS CARRIED OUT TWICE
2-1) CARRY OUT ABNORMAL PROCESS, IF PACKET LENGTH EXCEED MPSZ, AND CLASS SECTION IS CARRIED OUT IN WRR BUT WC SUBTRACTION IS NOT CARRIED OUT
2-2) WC SUBTRACTION IS NOT CARRIED OUT IN CASE

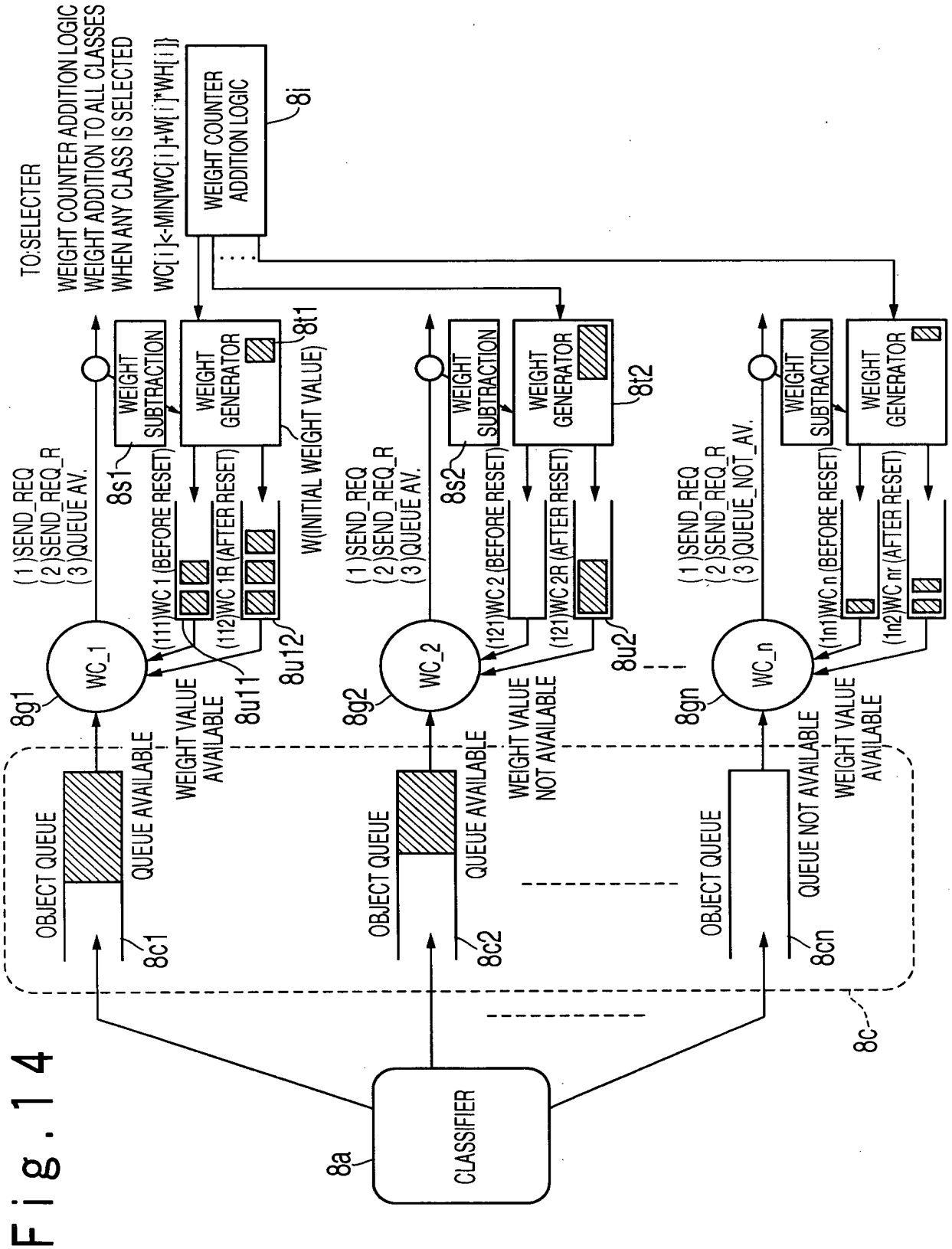
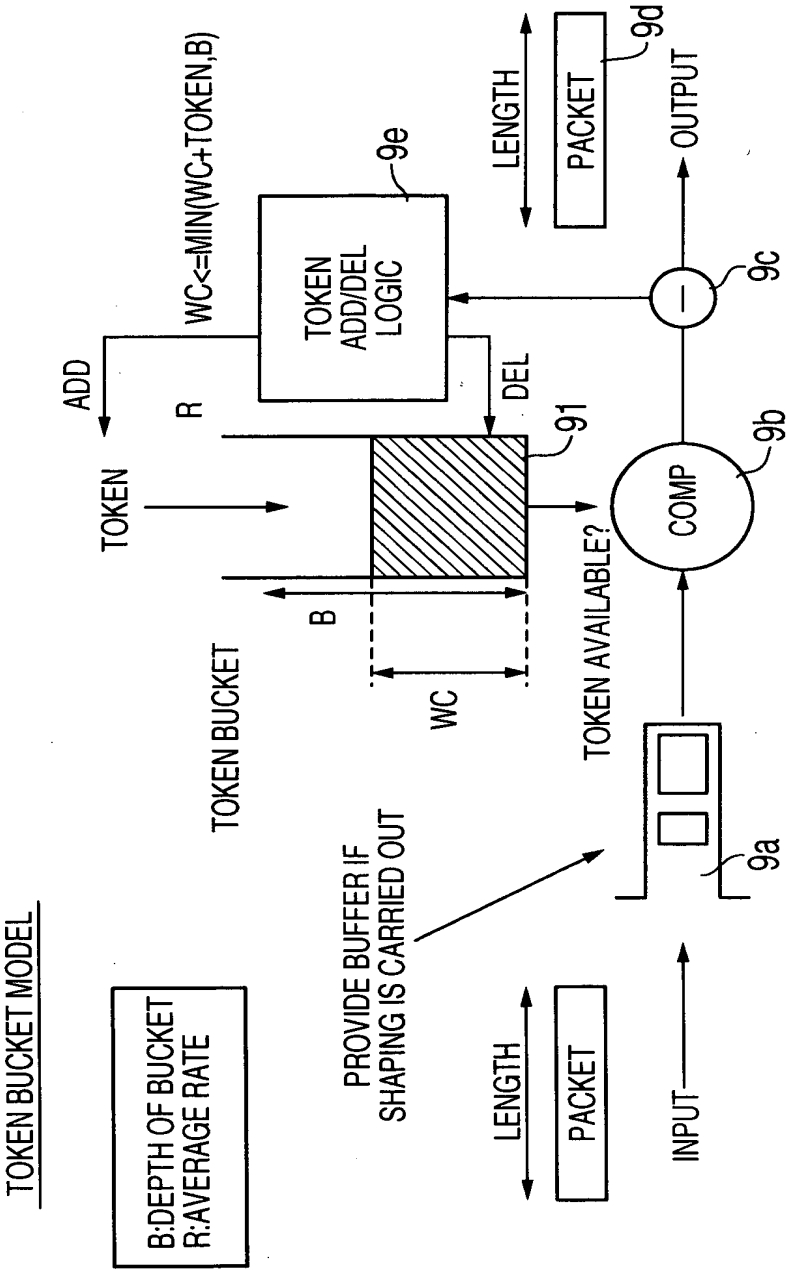

TO:SELECTER
WEIGHT COUNTER ADDITION LOGIC
WEIGHT ADDITION TO ALL CLASSES
WHEN ANY CLASS IS SELECTED
WC[i]<-MIN[WC[i]+Wf[i]*Wh[i]]
WEIGHT COUNTER ADDITION LOGIC
8i
WEIGHT SUBTRACTION
WEIGHT GENERATOR
8t1
W(INITIAL WEIGHT VALUE)
8s1
(1)SEND_REQ
(2)SEND_REQ_R
(3)QUEUE AV.
(111)WC 1 (BEFORE RESET)
(112)WC 1R (AFTER RESET)
8u12
8u11
WC_1
8g1
WEIGHT VALUE AVAILABLE
OBJECT QUEUE
QUEUE AVAILABLE
8c1
8t2
8s2
(121)WC 2 (BEFORE RESET)
(121)WC 2R (AFTER RESET)
8u2
WC_2
8g2
WEIGHT VALUE NOT AVAILABLE
8c2
(1)SEND_REQ
(2)SEND_REQ_R
(3)QUEUE_NOT_AV.
(1n1)WC n (BEFORE RESET)
(1n2)WC nr (AFTER RESET)
WC_n
8gn
QUEUE NOT AVAILABLE
8cn
8c
CLASSIFIER
8a

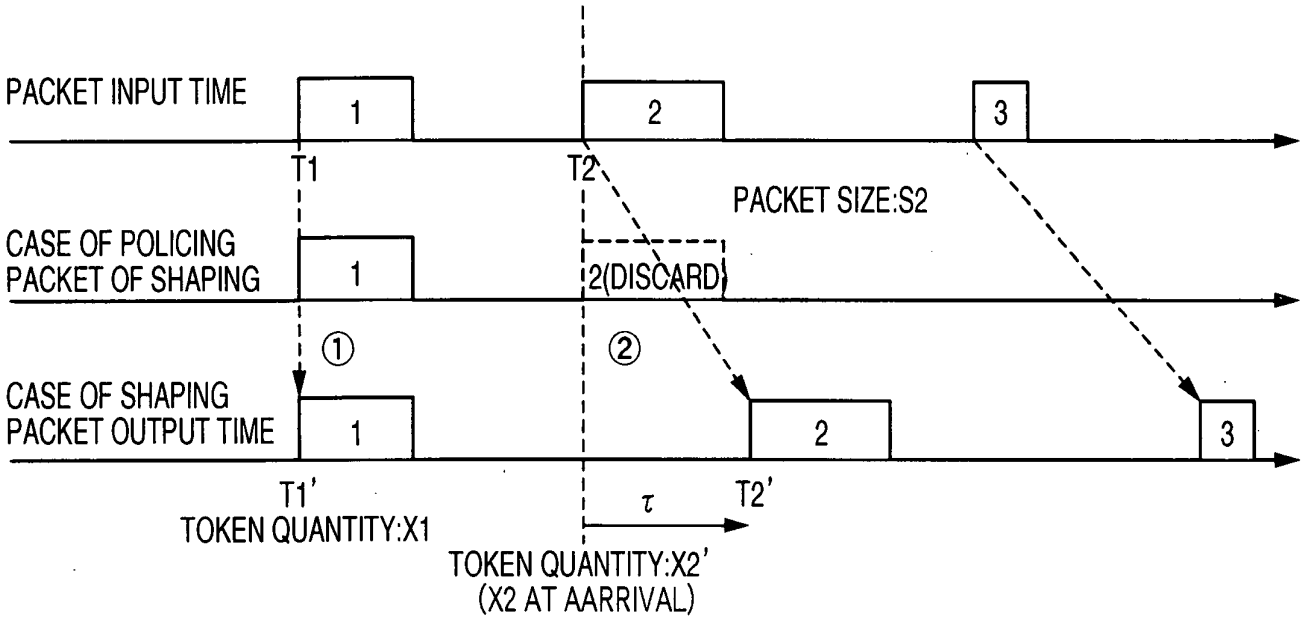
Fig. 14

Fig. 15


TOKEN BUCKET MODEL
B:DEPTH OF BUCKET
R:AVERAGE RATE
PROVIDE BUFFER IF
SHAPING IS CARRIED OUT
TOKEN BUCKET
TOKEN
ADD
R
WC<=MIN(WC+TOKEN,B)
TOKEN
ADD/DEL
LOGIC
9e
DEL
91
B
WC
TOKEN AVAILABLE?
COMP
9b
LENGTH
PACKET
9d
OUTPUT
9c
INPUT
LENGTH
PACKET
9a

TOEOTO" 02525760

Fig.16



1)TOKEN QUANTITIY AT TIME T2:X2=x1+(T2-T1)*R
LACK OF TOKEN,IF S2>X2
2)POLICING
IMMEDIATELY DISCARD
3)SHAPING
NOT LACK OF TOKEN,IF PACKET IS TRANSMITTED AT TIME
(τ+T2)(S2=X1+{(τ+T2)-T1}*R).PACKET IS TRANSMITTED WITH DELAY τ

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